



# Replacement Sheet

1/39

+

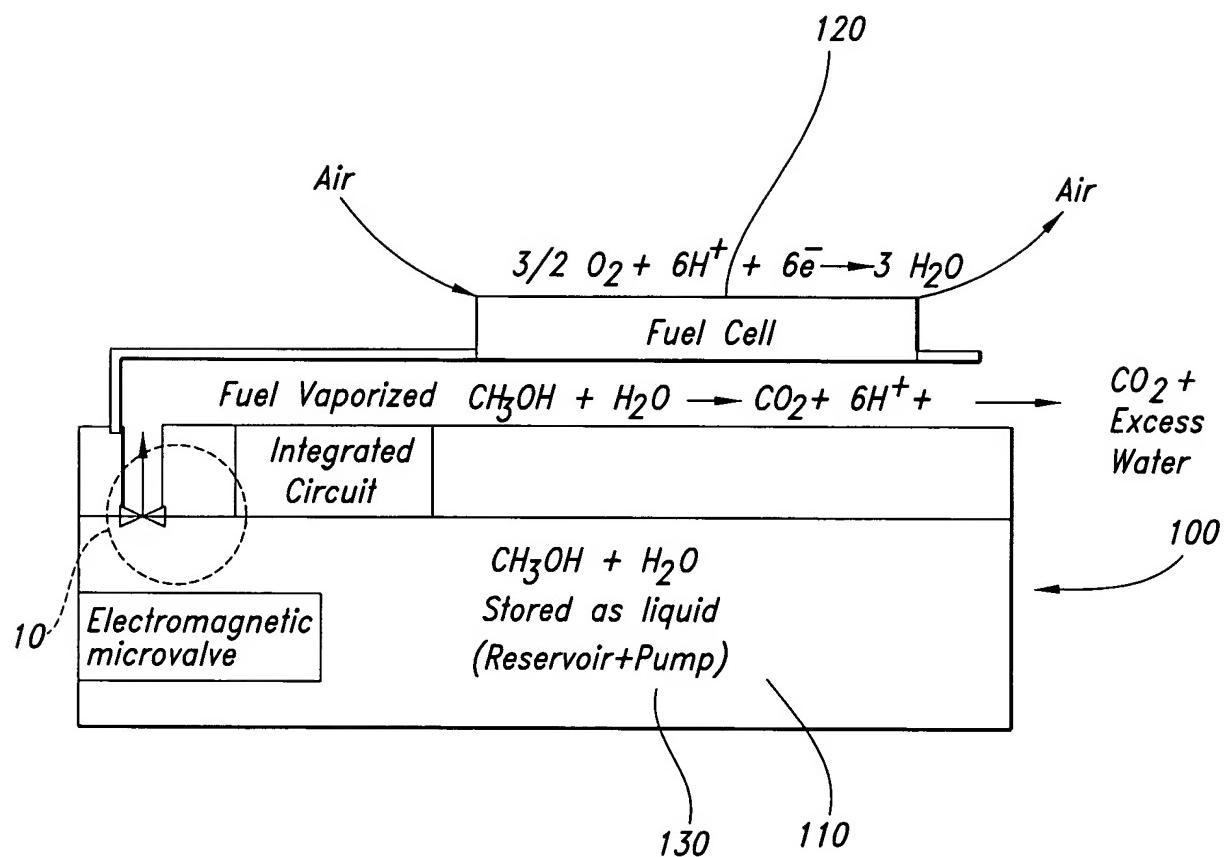


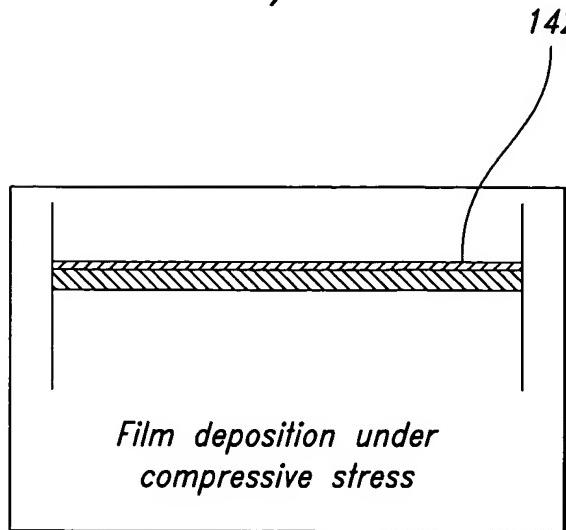
FIG. 1

+

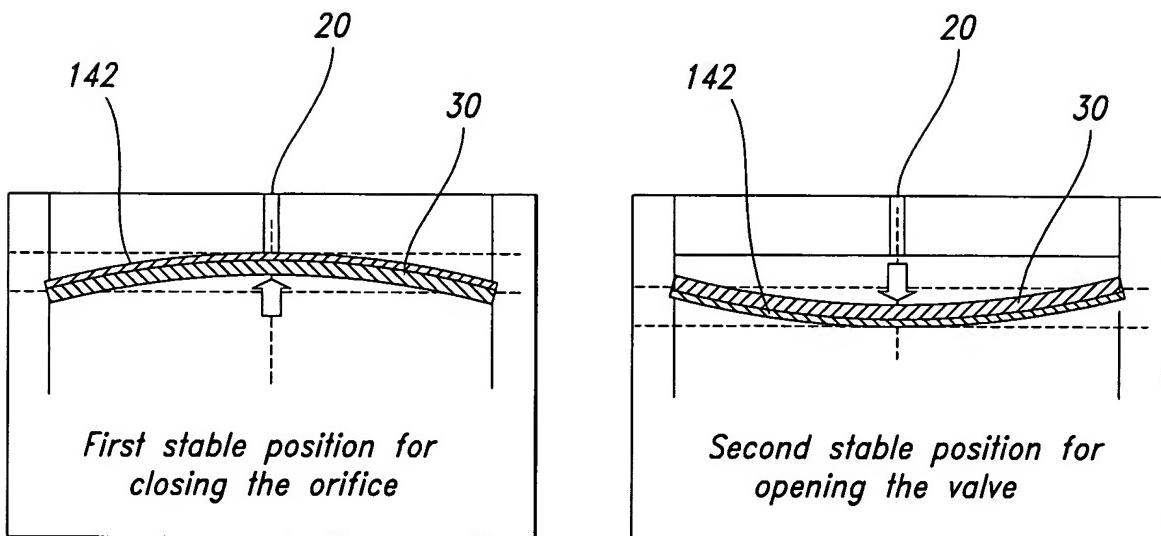
*Replacement Sheet*

*2/39*

*+*



**FIG. 2A**



**FIG. 2B**

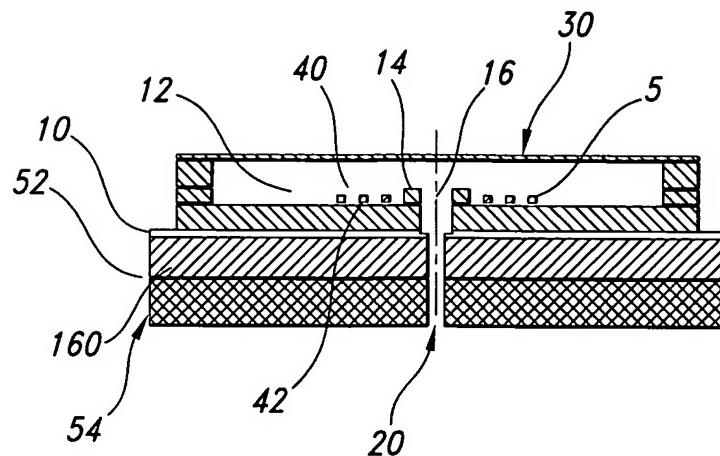
**FIG. 2C**

*+*

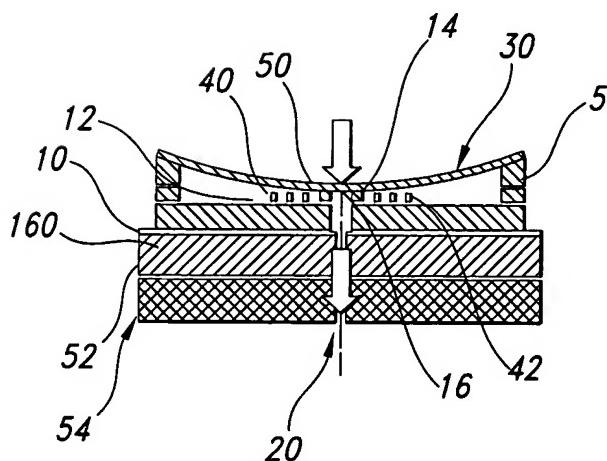
*Replacement Sheet*

3/39

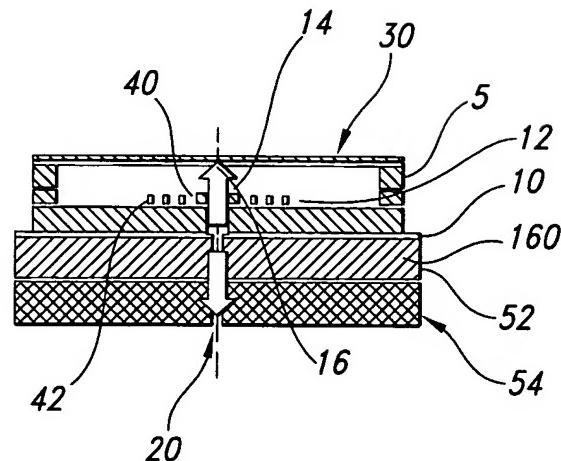
+



**FIG. 3A**



**FIG. 3B**



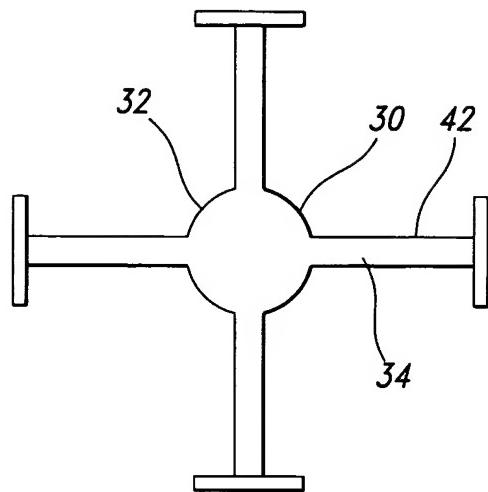
**FIG. 3C**

+

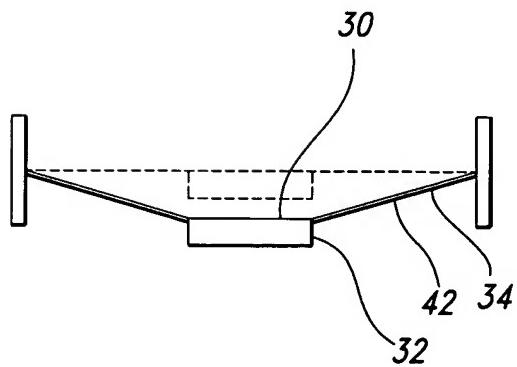
*Replacement Sheet*

+

4/39



**FIG. 4A**



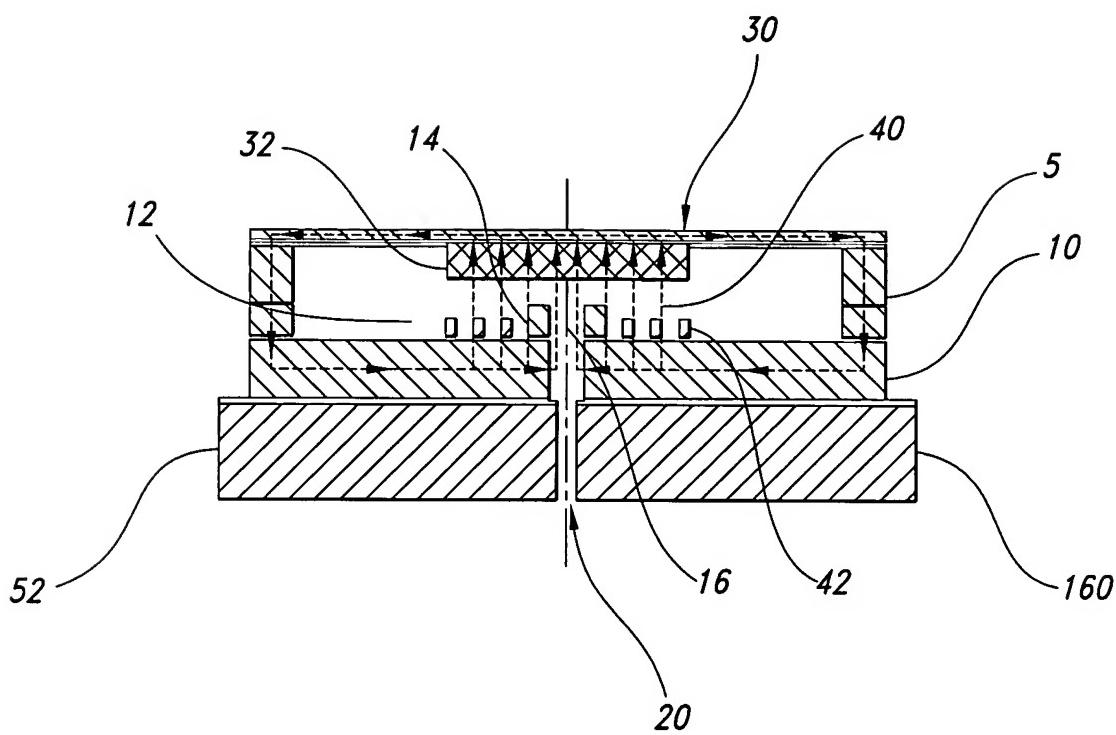
**FIG. 4B**

+

*Replacement Sheet*

+

5/39



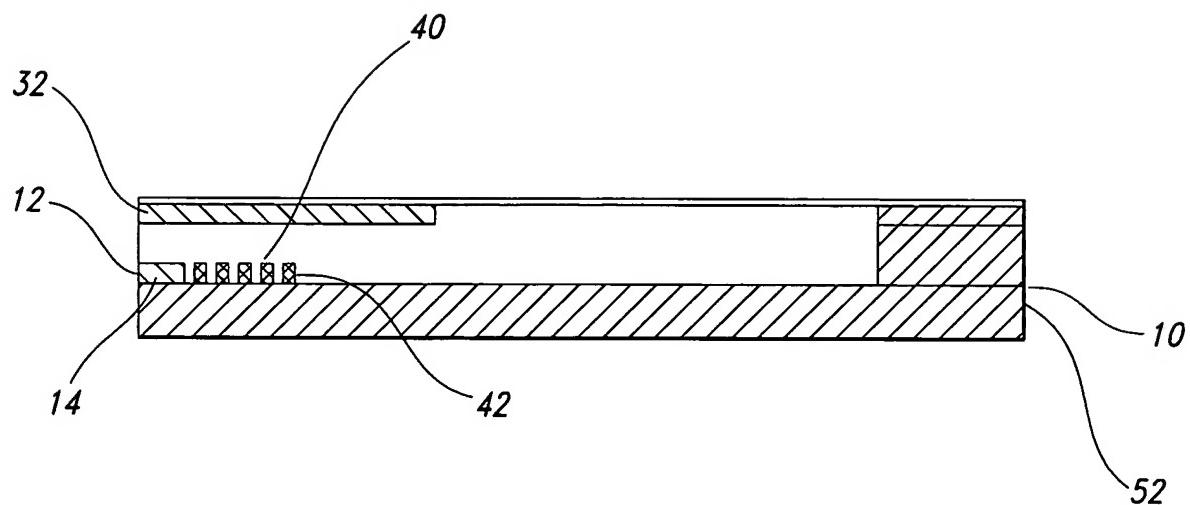
**FIG. 5**

+

*Replacement Sheet*

+

6/39



**FIG. 6**

+

*Replacement Sheet*

7/39

+

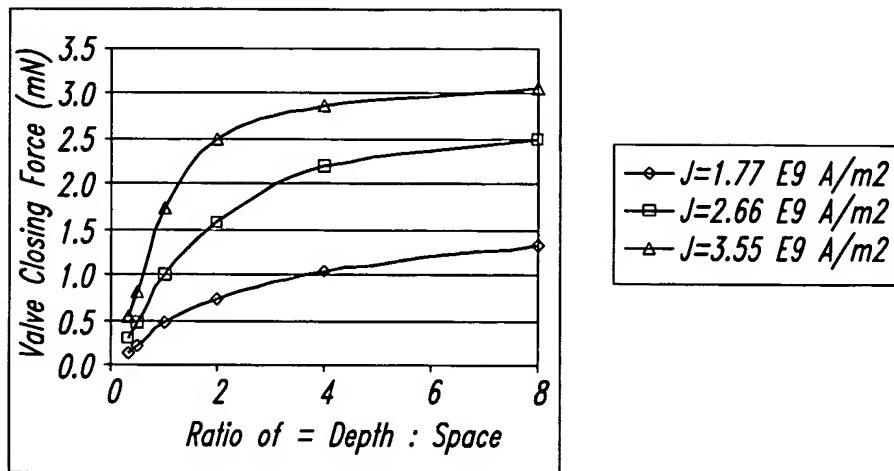


FIG. 7

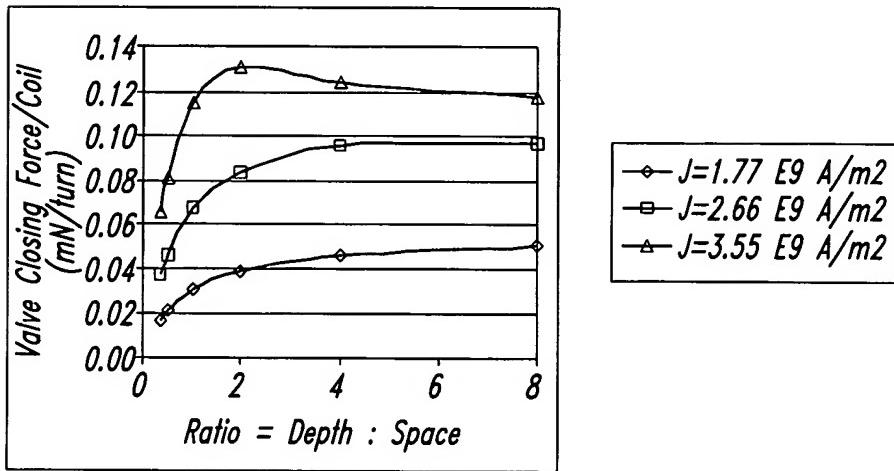


FIG. 8

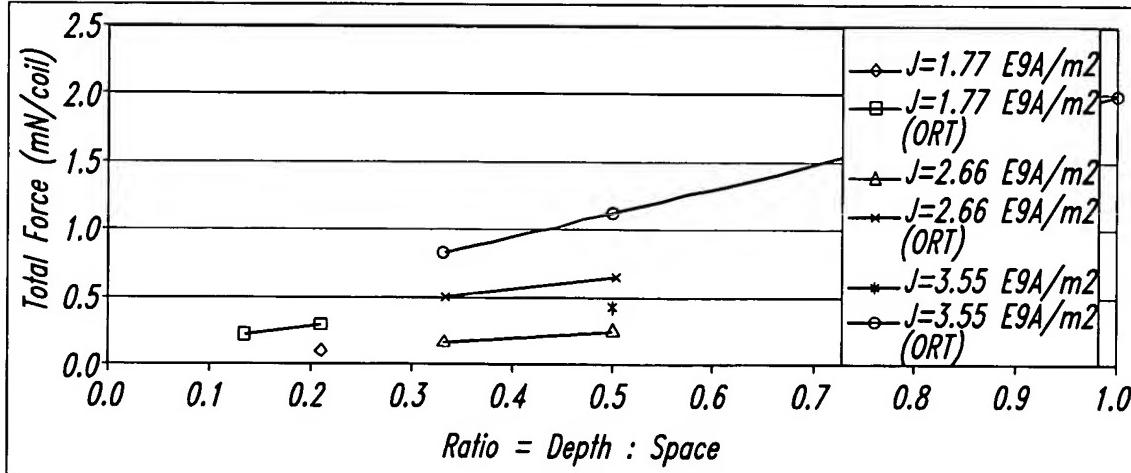


FIG. 9

+

# Replacement Sheet

8/39

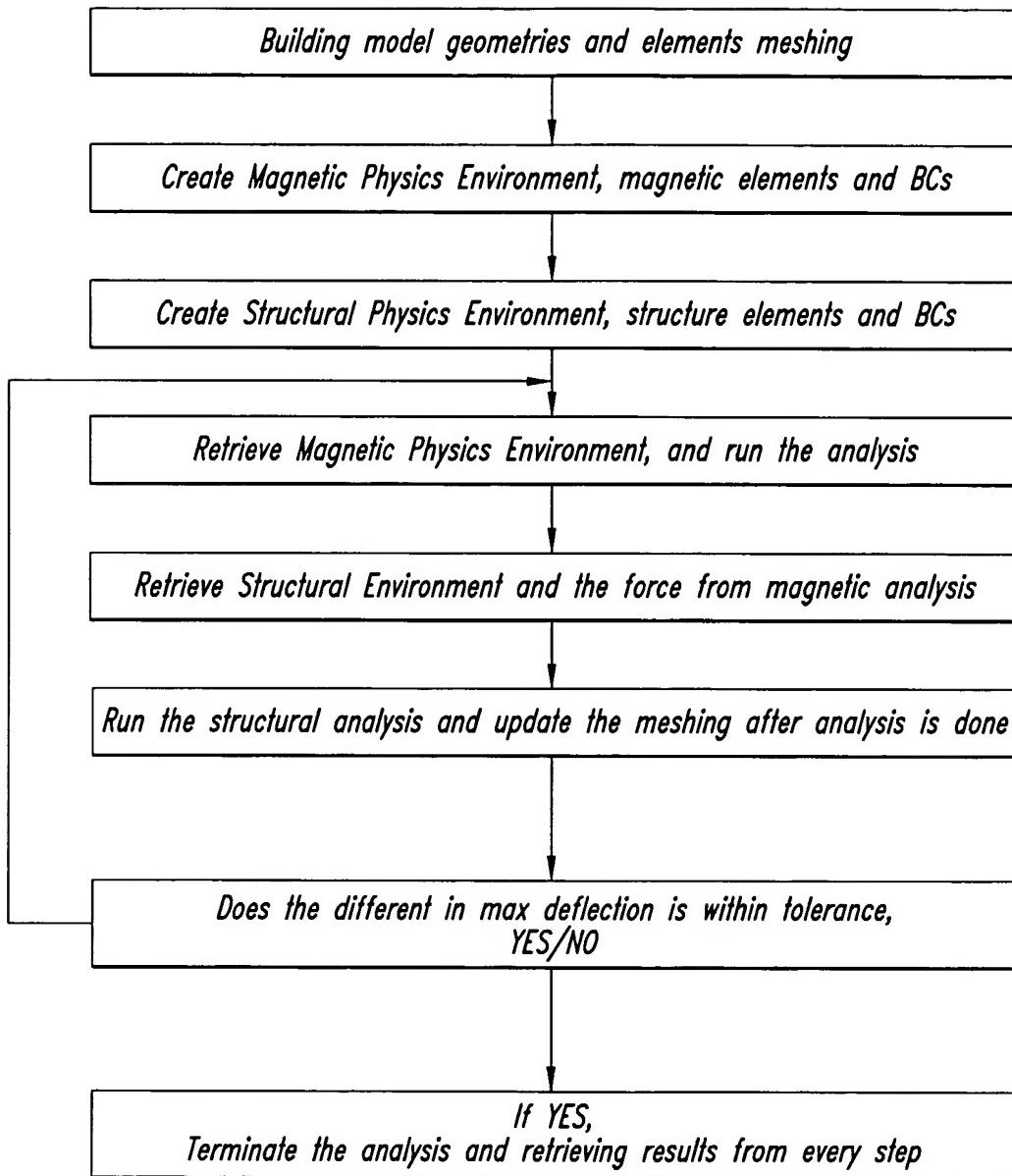
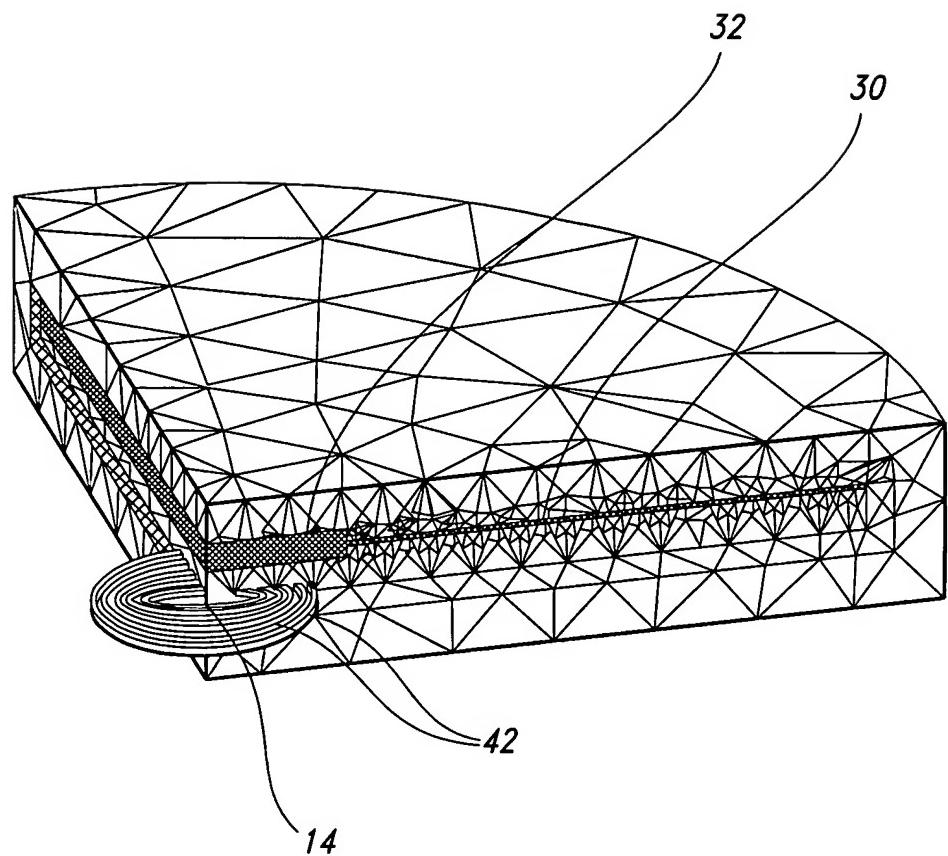


FIG. 10

*Replacement Sheet*

9/39

+

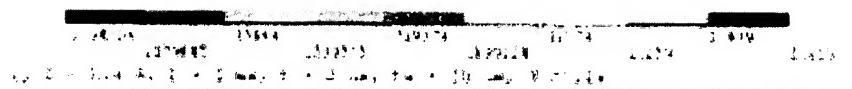
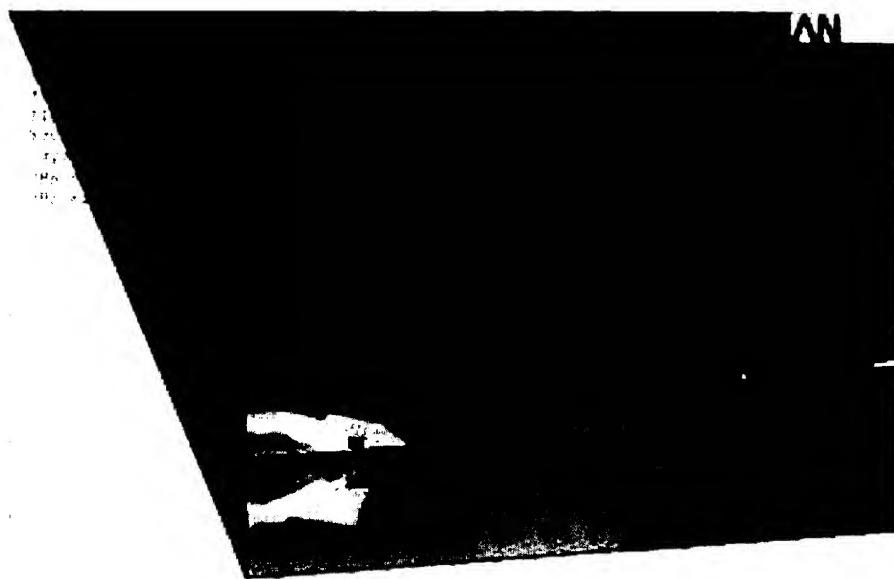


**FIG. 11**

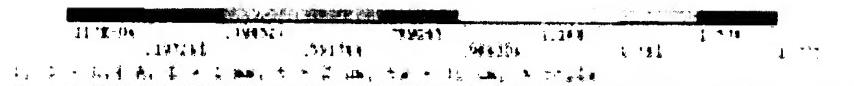
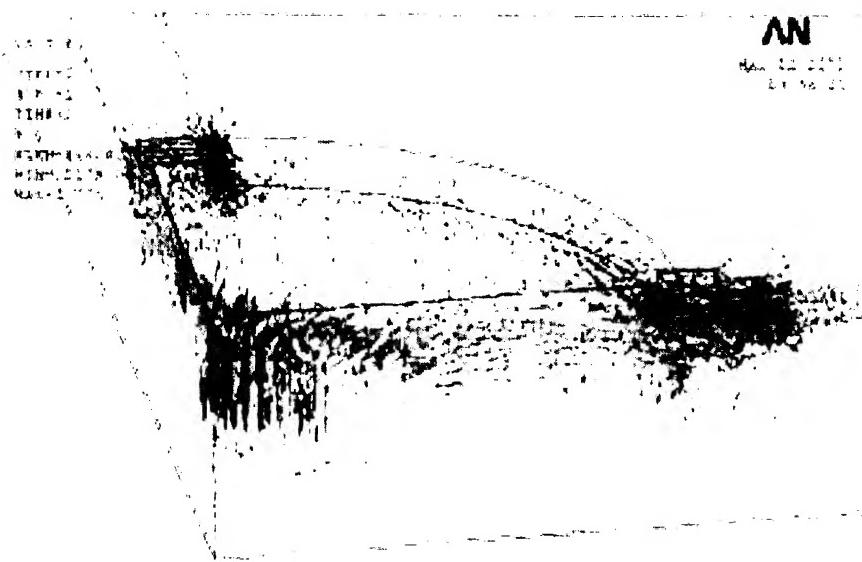
+

*Replacement Sheet*

10/39



**FIG. 12A**



**FIG. 12B**

## *Replacement Sheet*

11 / 39

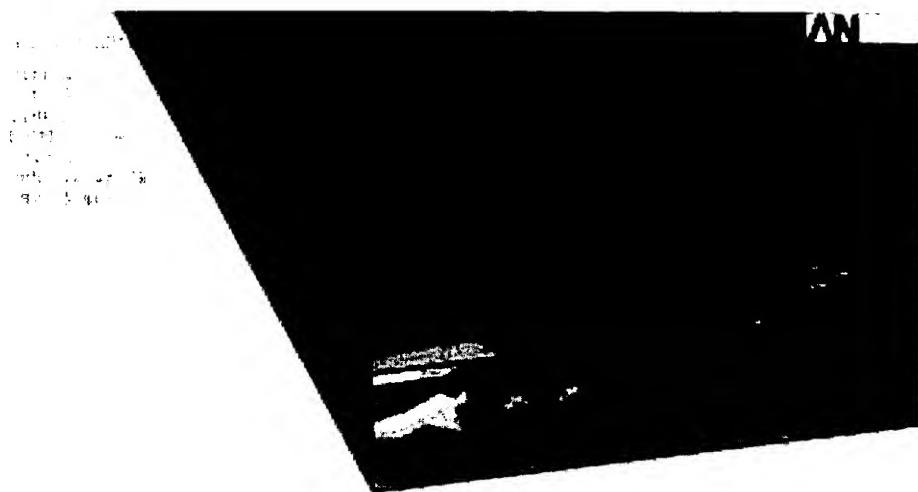


FIG. 13A

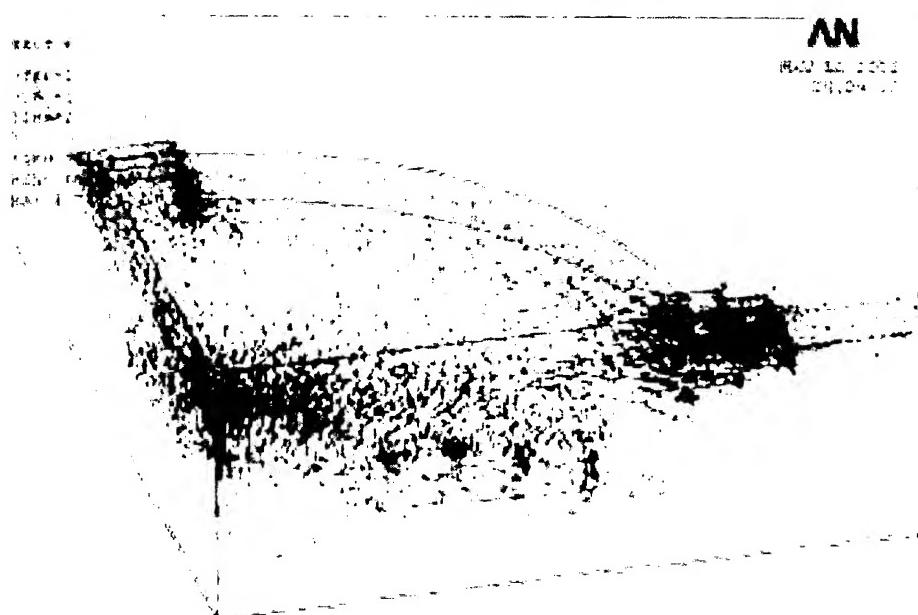


FIG. 13B

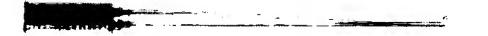
*Replacement Sheet*

12/39

AN

+

**FIG. 14A**



AN

**FIG. 14B**



AN

**FIG. 14C**



AN

**FIG. 14D**

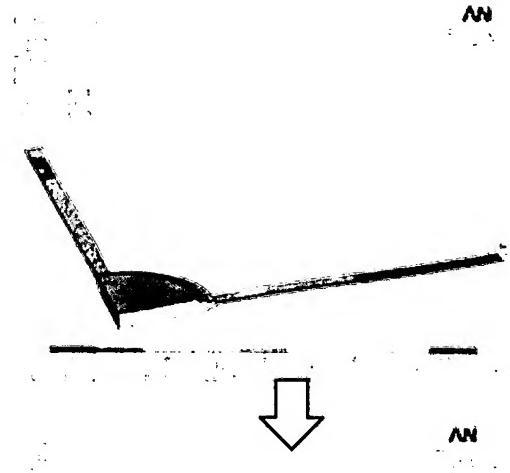


+

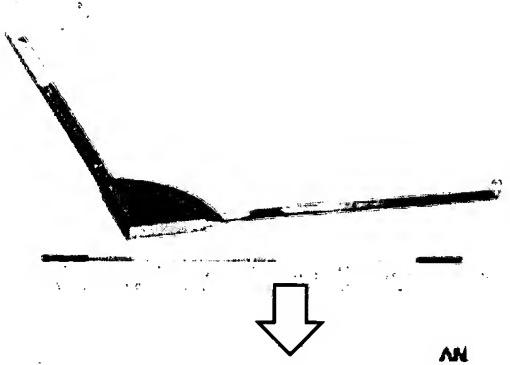
*Replacement Sheet*

+

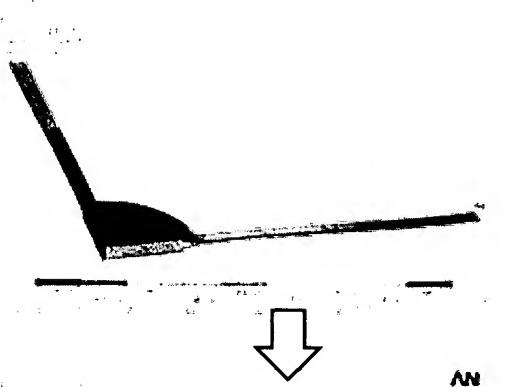
13/39



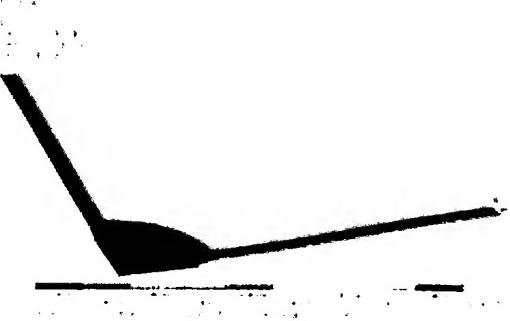
**FIG. 15A**



**FIG. 15B**



**FIG. 15C**

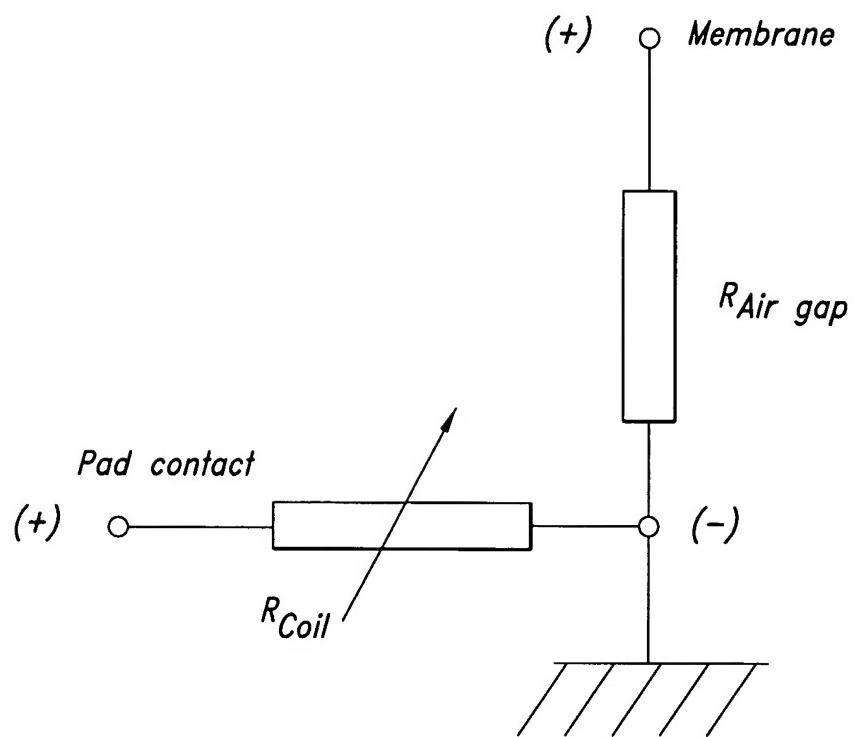


**FIG. 15D**

*Replacement Sheet*

*14/39*

+



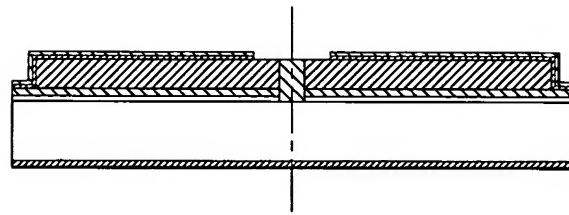
**FIG. 16**

+

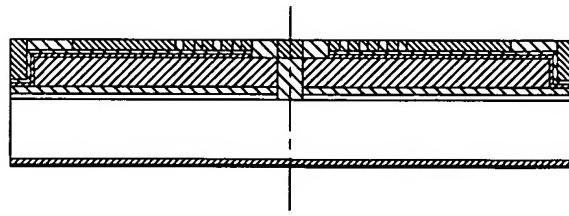
*Replacement Sheet*

*15/39*

+



**FIG. 17A**



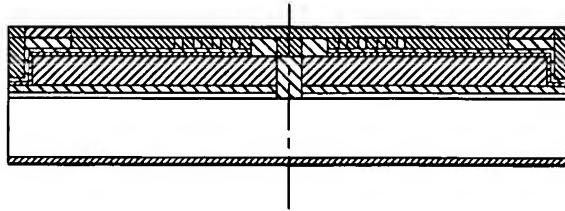
**FIG. 17B**

+

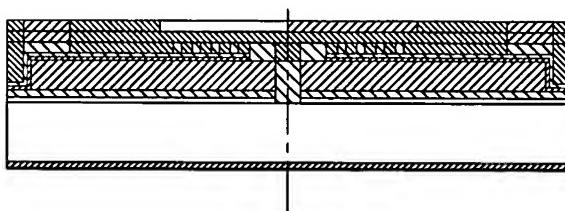
*Replacement Sheet*

+

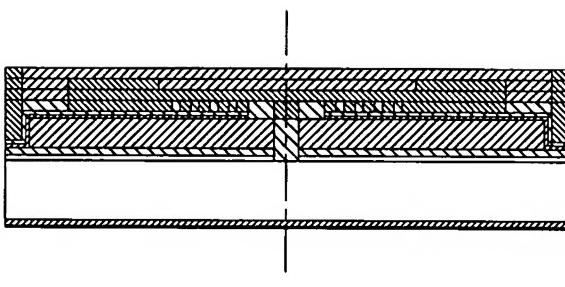
16/39



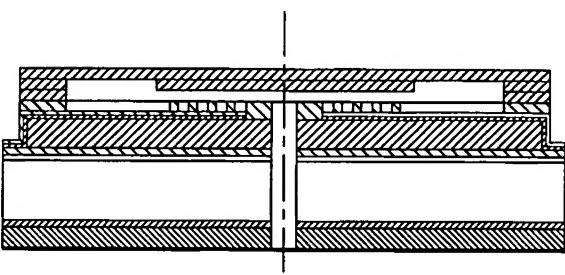
**FIG. 17C**



**FIG. 17D**



**FIG. 17E**



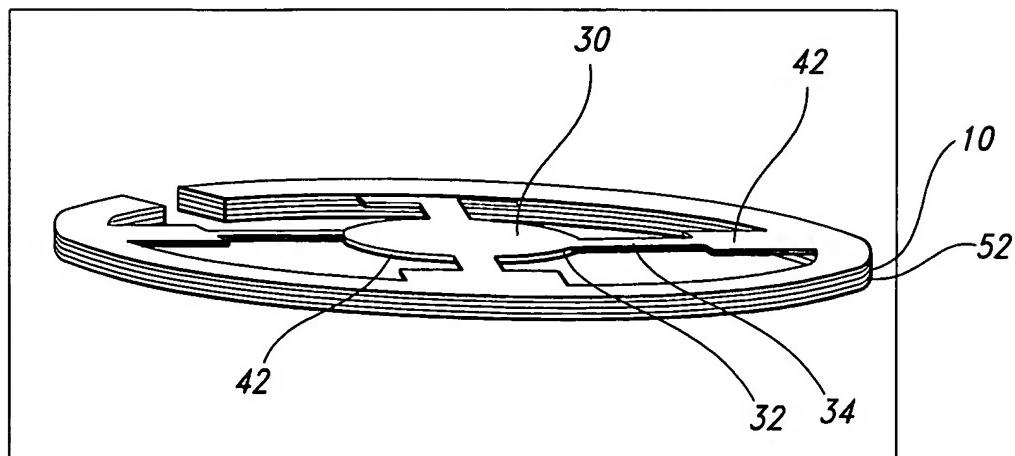
**FIG. 17F**

+

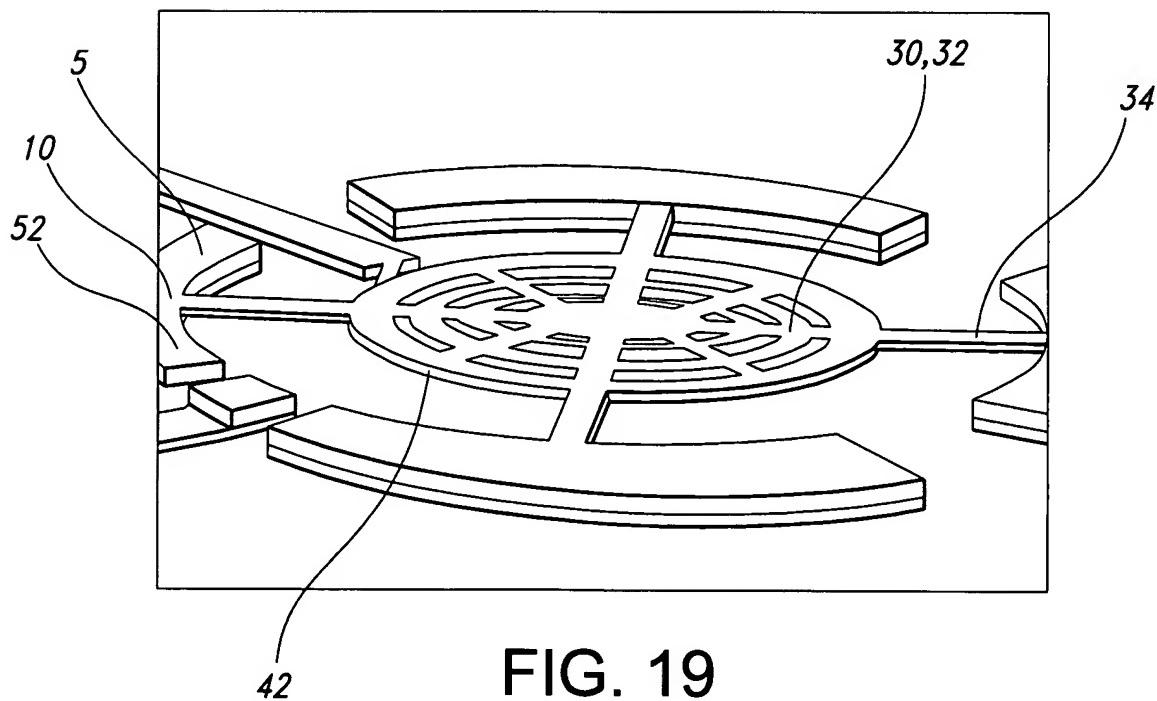
*Replacement Sheet*

17/39

+



**FIG. 18**



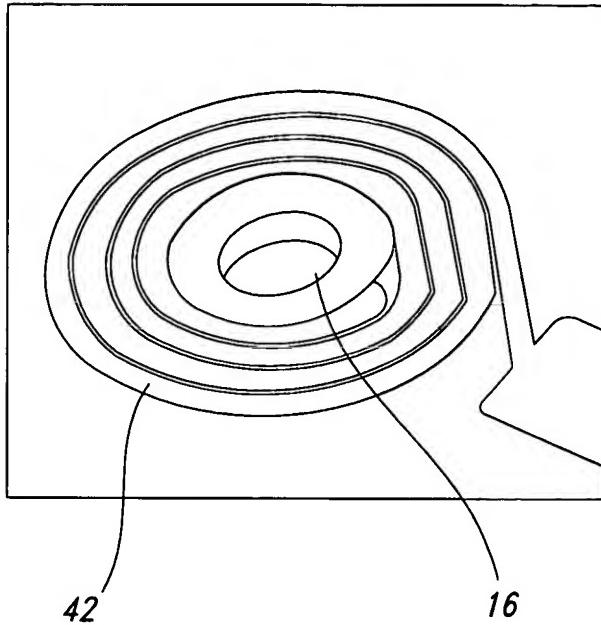
**FIG. 19**

+

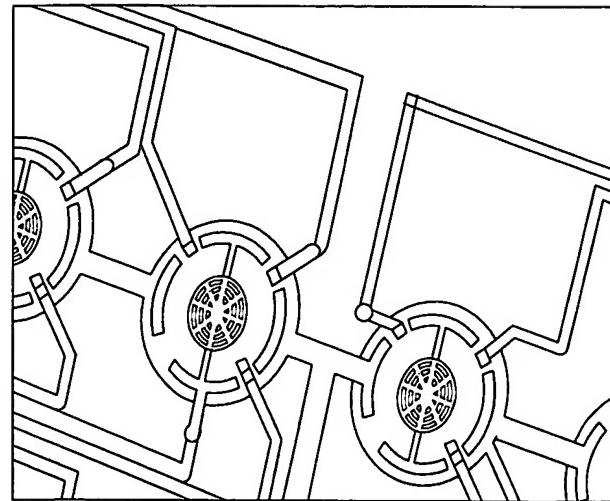
*Replacement Sheet*

+

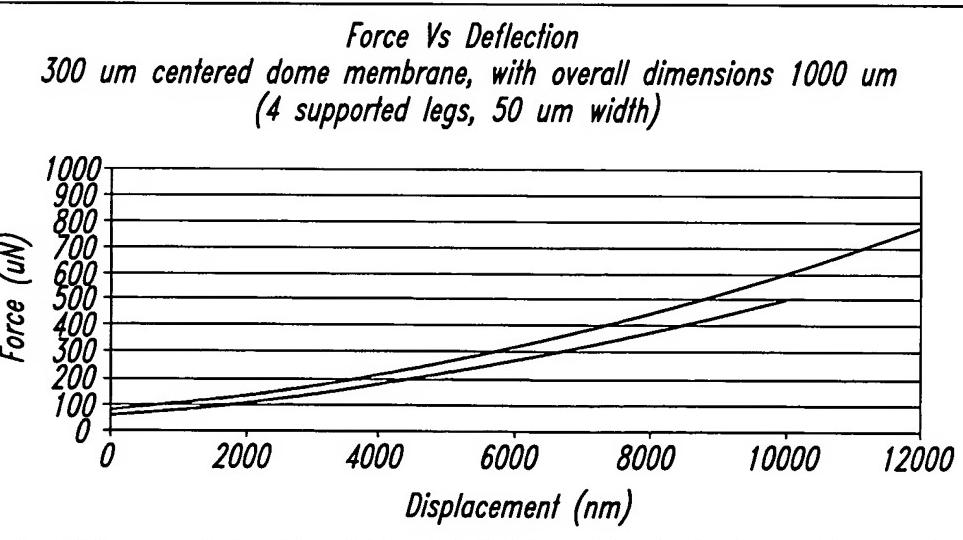
18/39



**FIG. 20**



**FIG. 21**



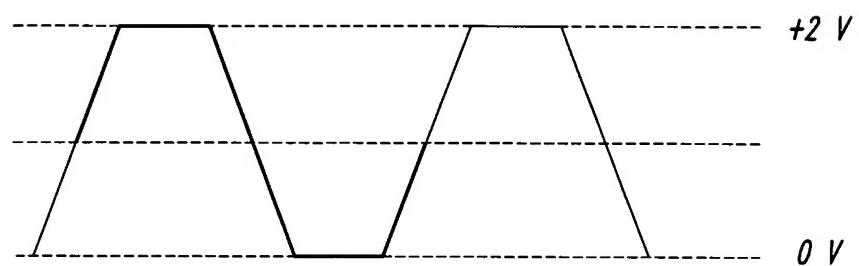
**FIG. 22**

+

*Replacement Sheet*

+

*19/39*



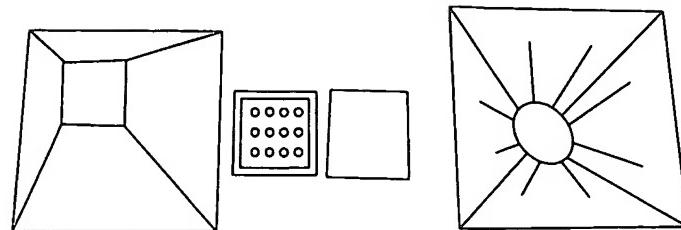
**FIG. 23**

+

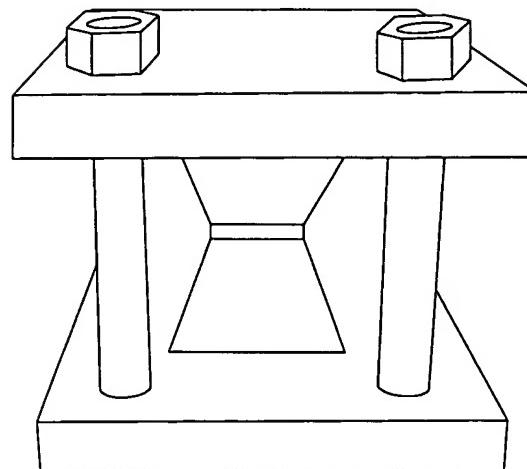
*Replacement Sheet*

20/39

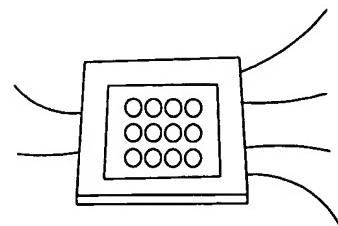
+



**FIG. 24A**



**FIG. 24B**



**FIG. 24C**

+

# Replacement Sheet

21/39

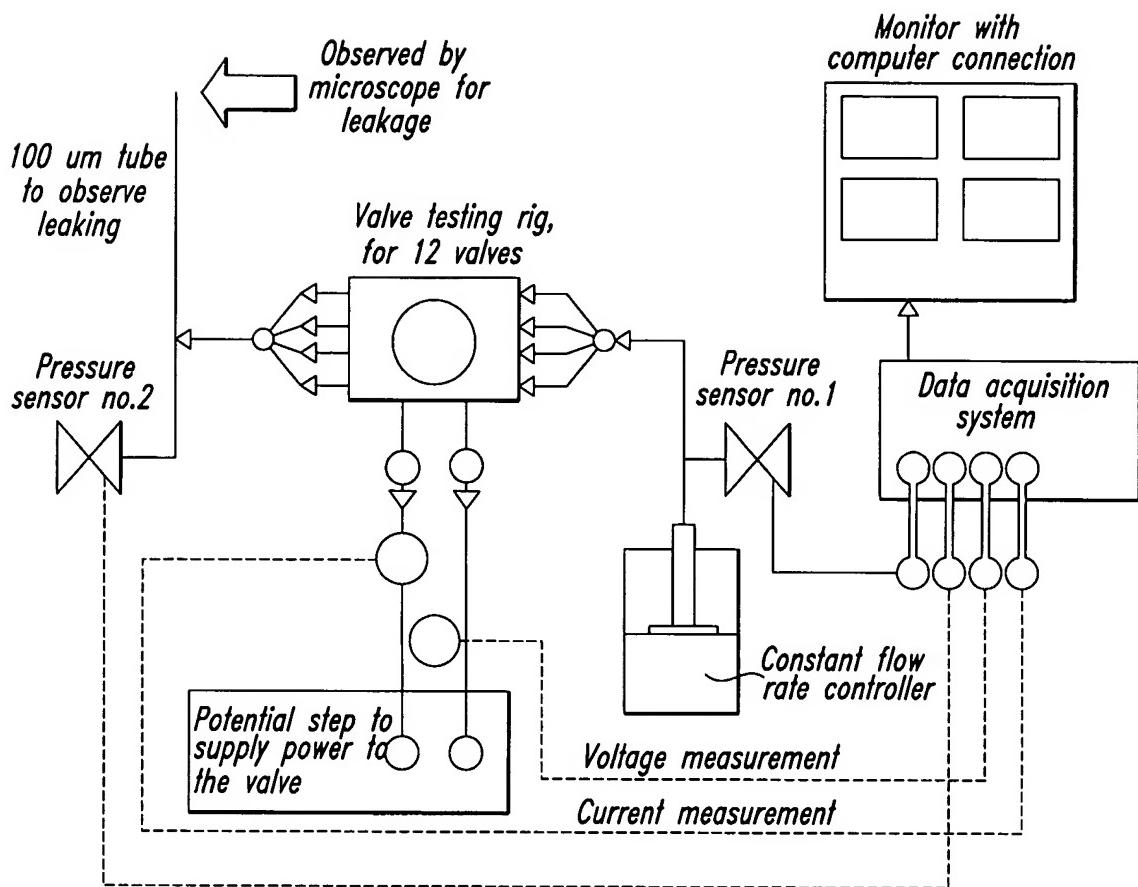
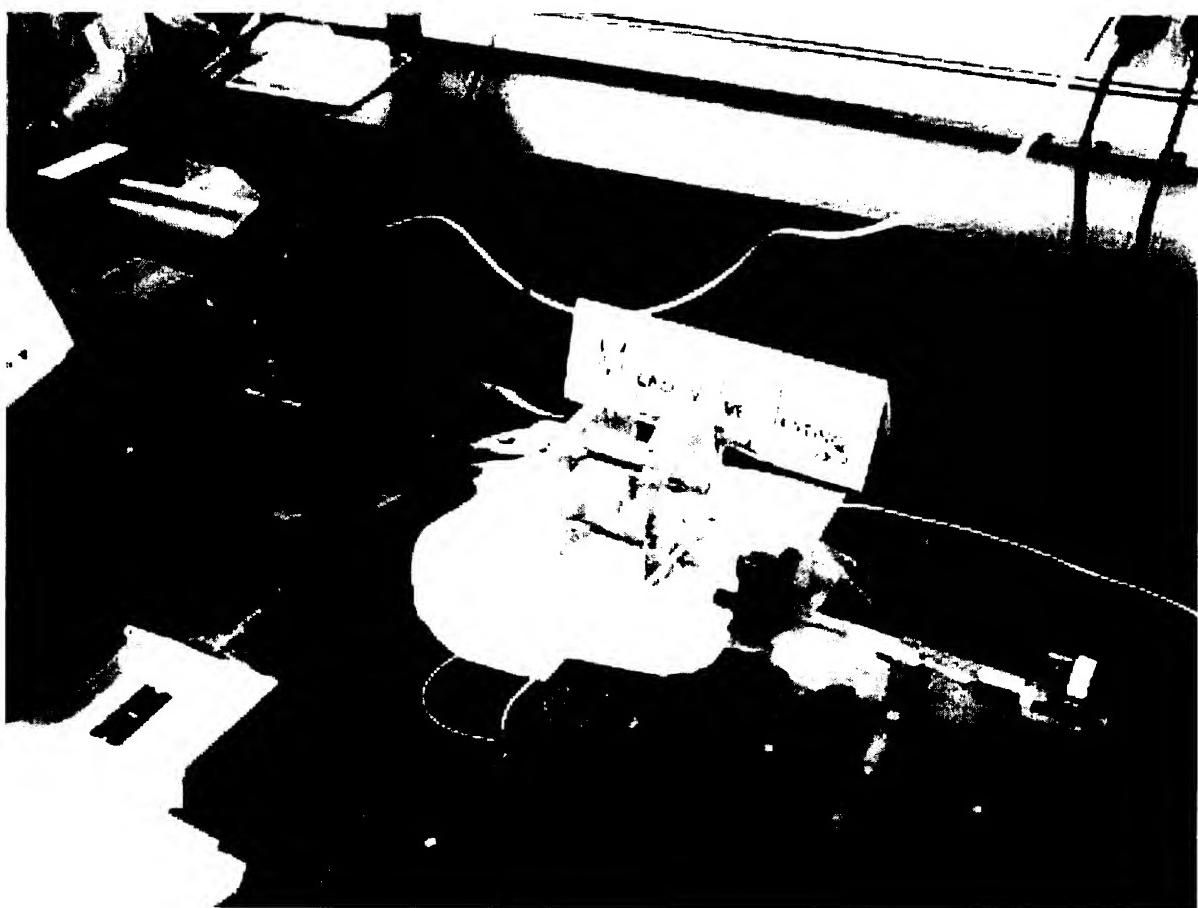


FIG. 25

*Replacement Sheet*

22/39

+



**FIG. 26**

+

# Replacement Sheet

23/39

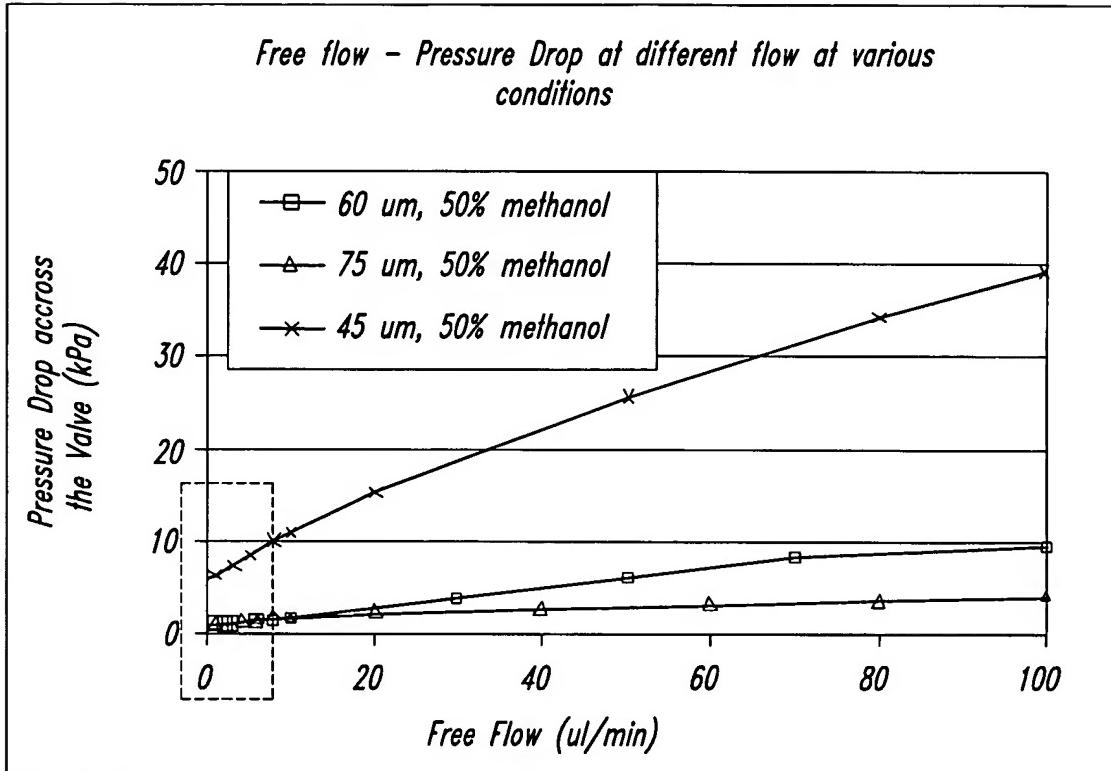


FIG. 27

# Replacement Sheet

24/39

+

Testing in the valve actuation; The free flow is 1  $\mu\text{l}/\text{min}$  at pressure drop is 0.65 kPa; Corrugated Membrane with 4 parallel-spring-legs; Orifice diameter is 60  $\mu\text{m}$ ; Coil resistance: 3.1 ohm; Voltage applied for actuation: 1.96 V

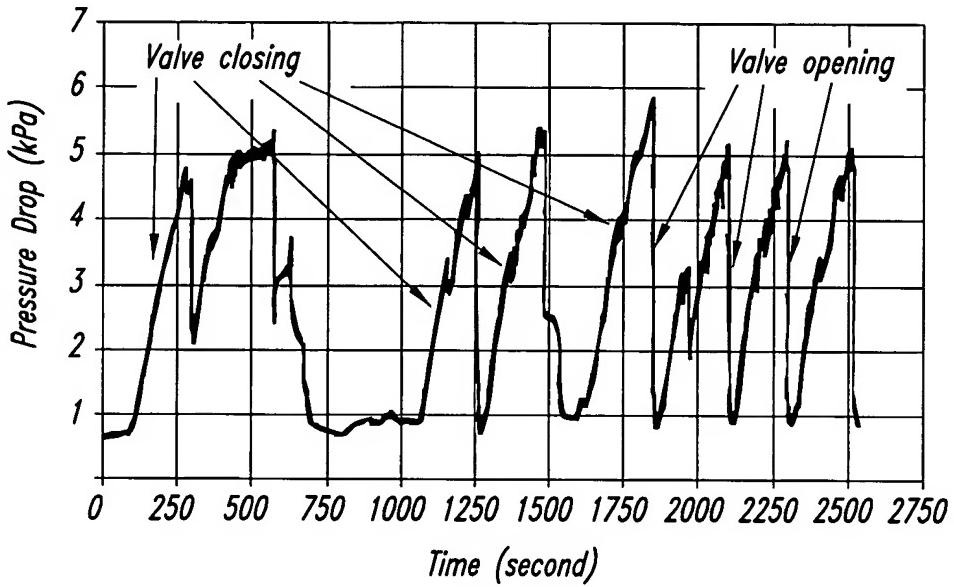


FIG. 28

+

Replacement Sheet

+

25/39

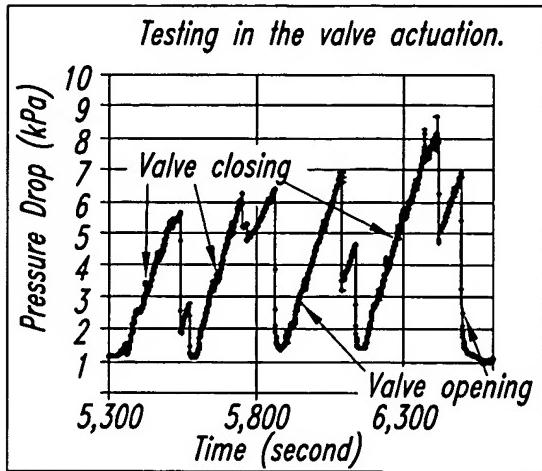


FIG. 29

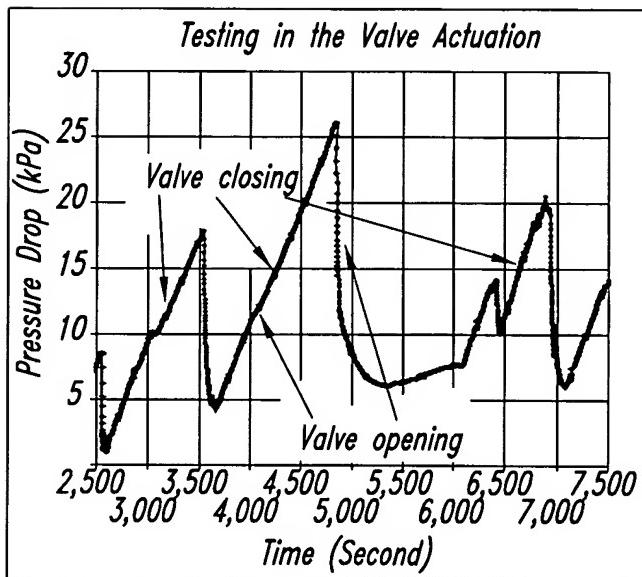


FIG. 30

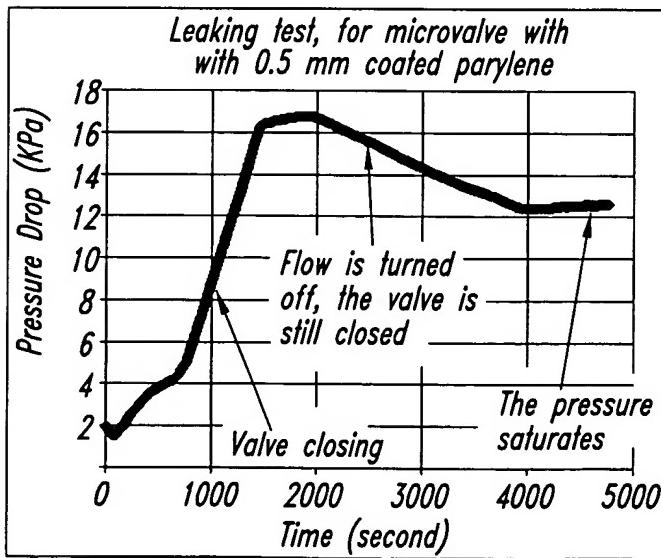


FIG. 31

*Replacement Sheet*

26/39

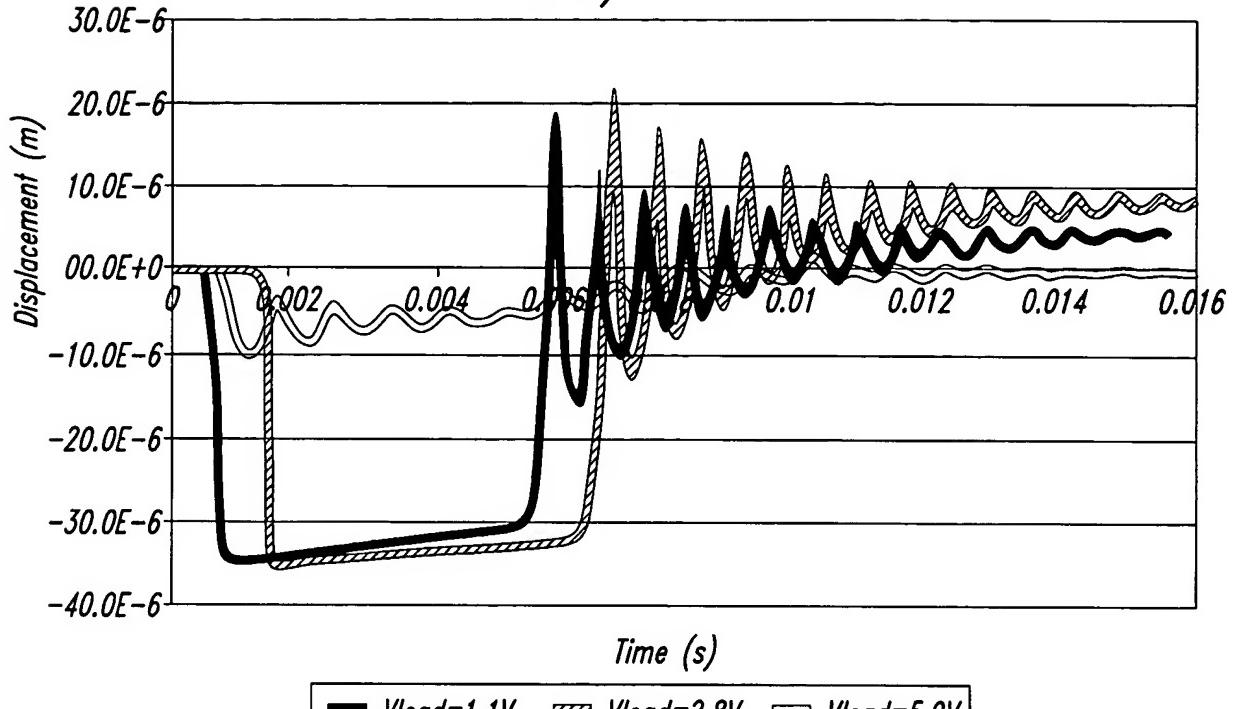


FIG. 32

*Sample of responses for varing  $V_{load}$  values with  $f_b = 1\text{kHz}$*

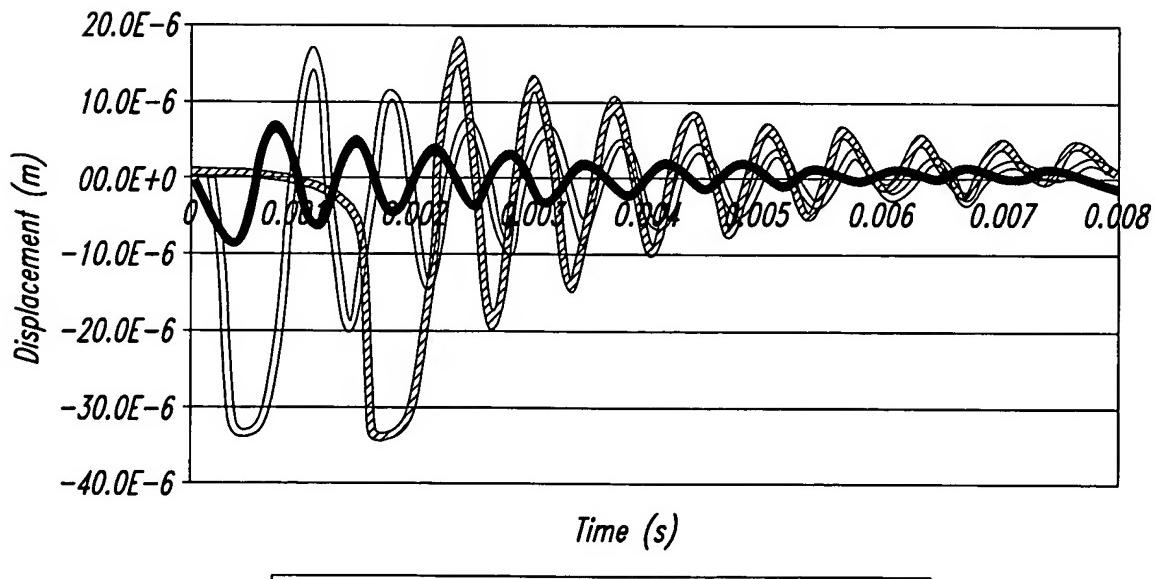


FIG. 33

*Replacement Sheet*

27/39

*Velocity and Displacement of Microvalve*  
 $f_b = 1\text{kHz}$ ;  $V_{load} = 3.28V$

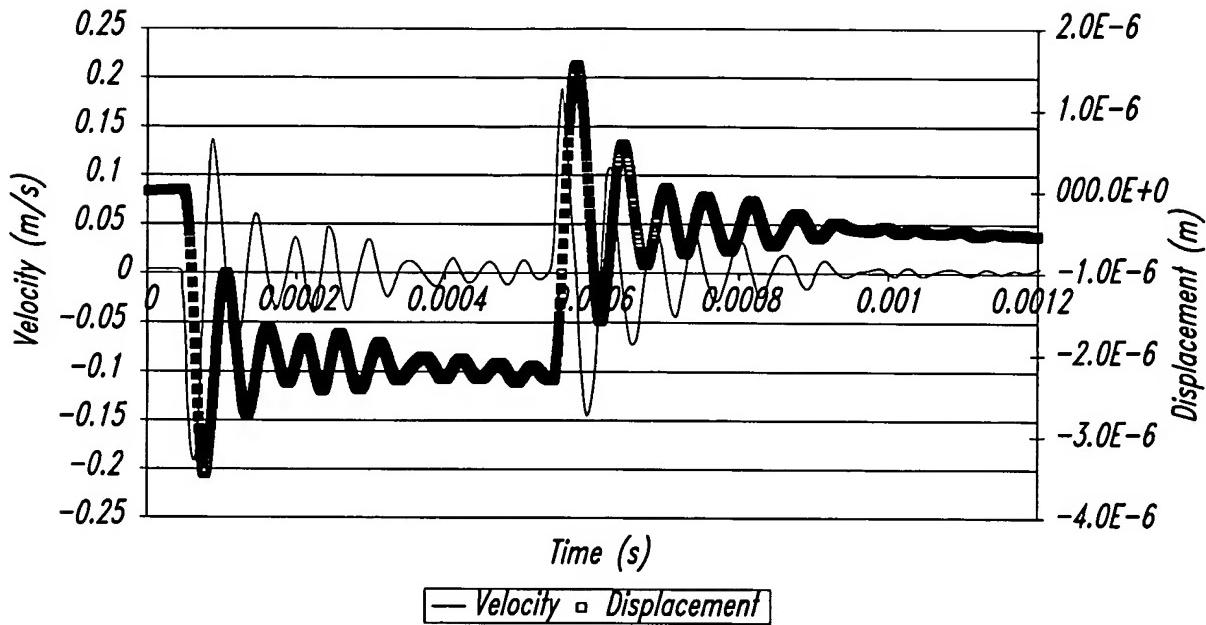


FIG. 34

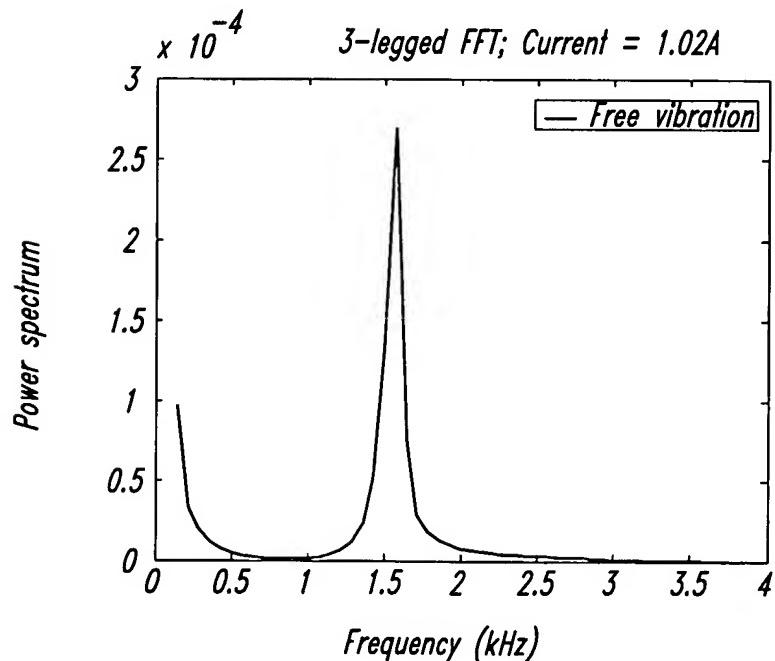
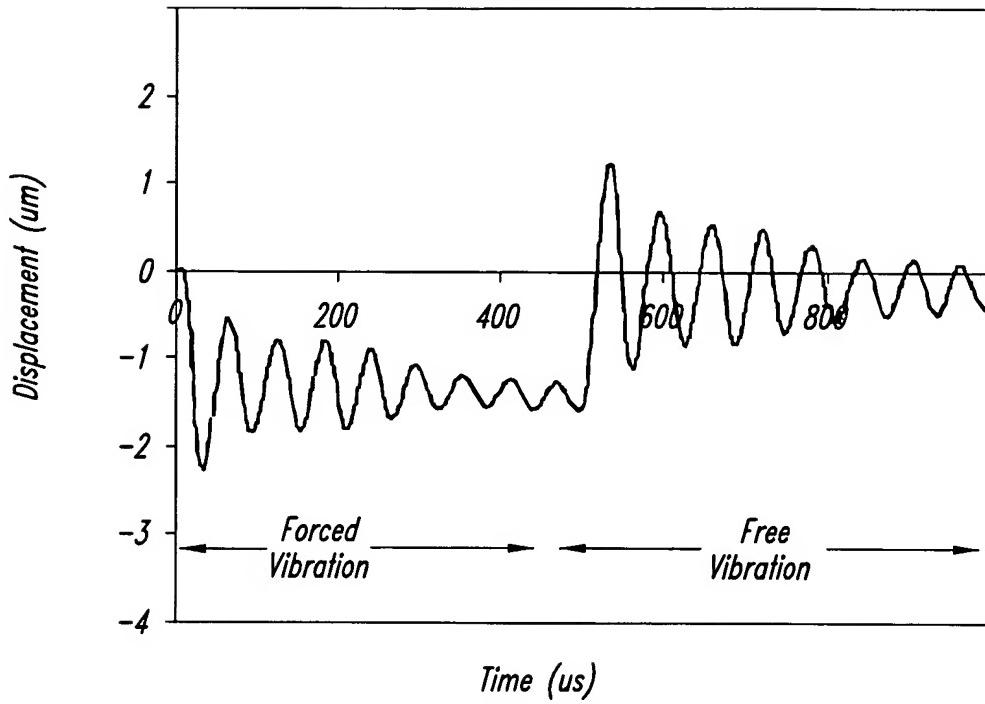


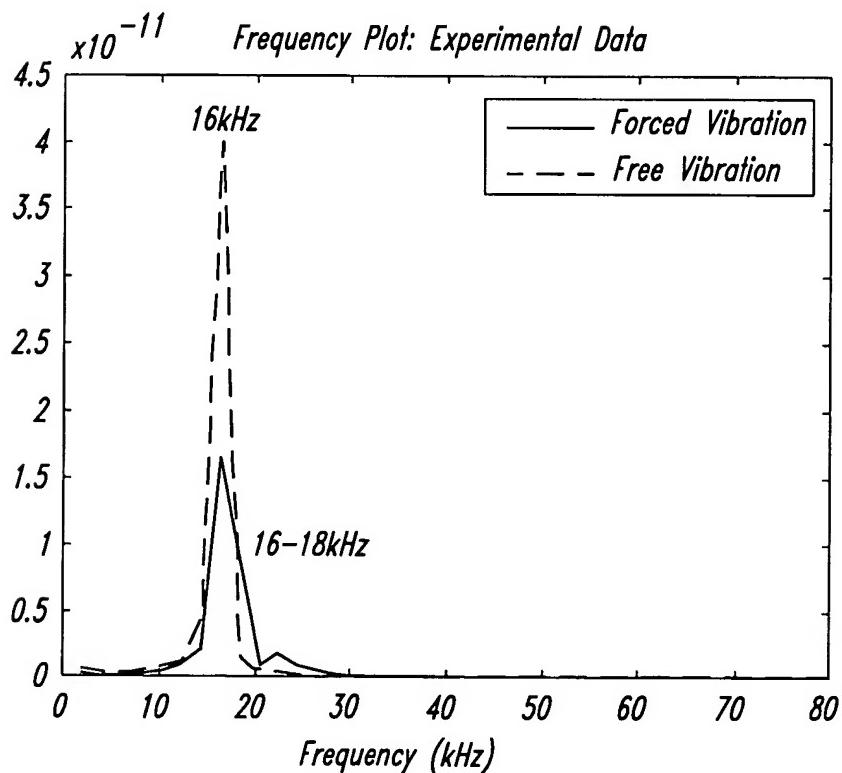
FIG. 35

*Replacement Sheet*

*28/39  
Experimental Response*



**FIG. 36**

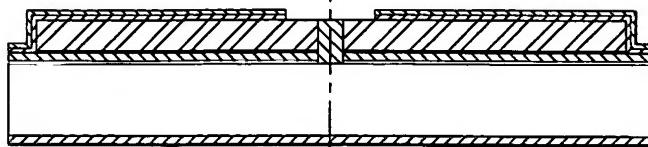


**FIG. 37**

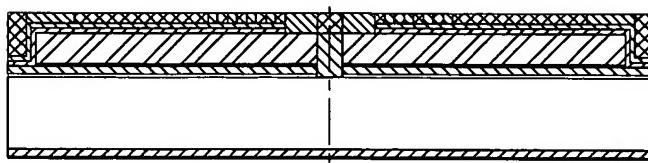
*Replacement Sheet*

+

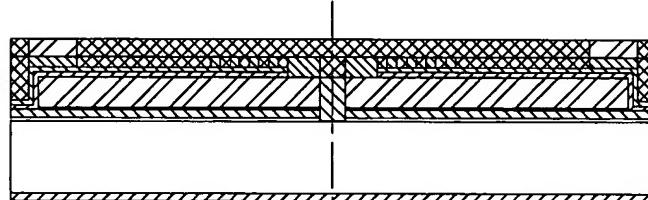
29/39



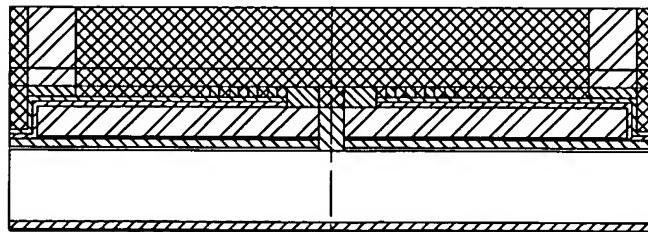
**FIG. 38A**



**FIG. 38B**



**FIG. 38C**



**FIG. 38D**

*Legend:*



*NiFe*



*PR, AZ 4620*



*SiO<sub>2</sub>*



*Permanent Magnet*



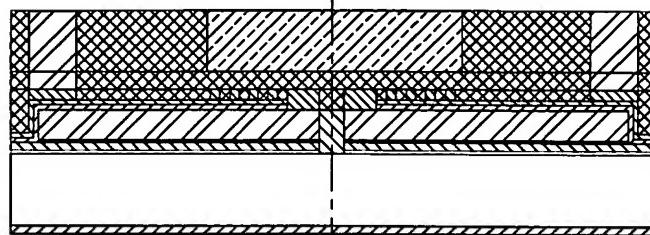
*Cu*

+

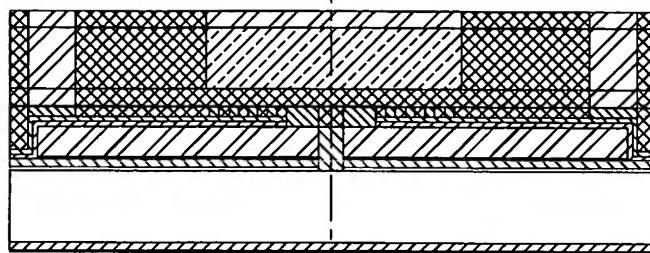
*Replacement Sheet*

+

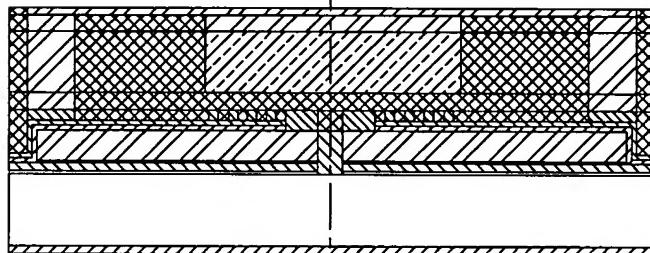
*30/39*



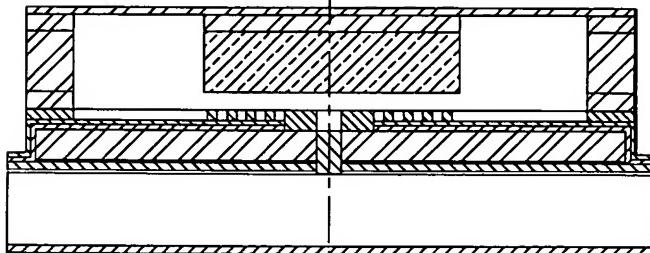
**FIG. 38E**



**FIG. 38F**



**FIG. 38G**



**FIG. 38H**

*Legend:*



*NiFe*



*PR, AZ 4620*



*SiO<sub>2</sub>*



*Permanent Magnet*



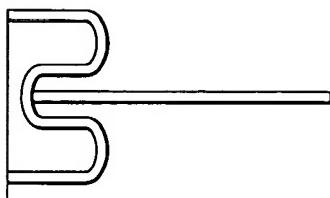
*Cu*

+

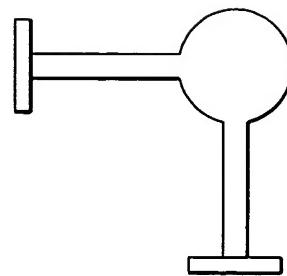
*Replacement Sheet*

31/39

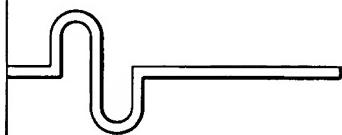
+



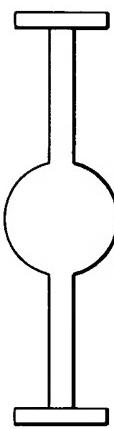
**FIG. 39A**



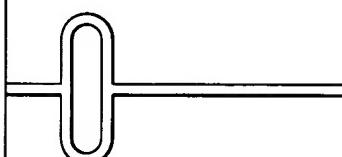
**FIG. 40A**



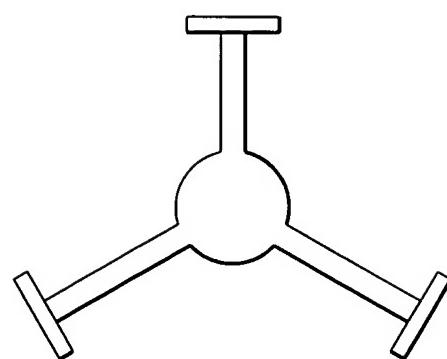
**FIG. 39B**



**FIG. 40B**



**FIG. 39C**



**FIG. 40C**

+

*Replacement Sheet*

32/39

+

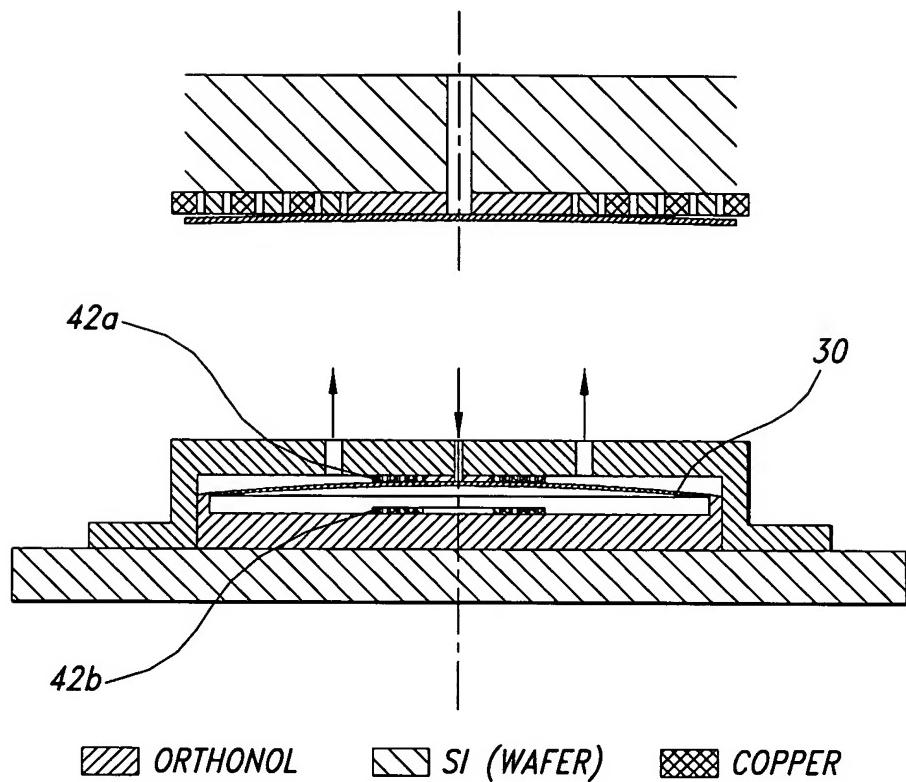


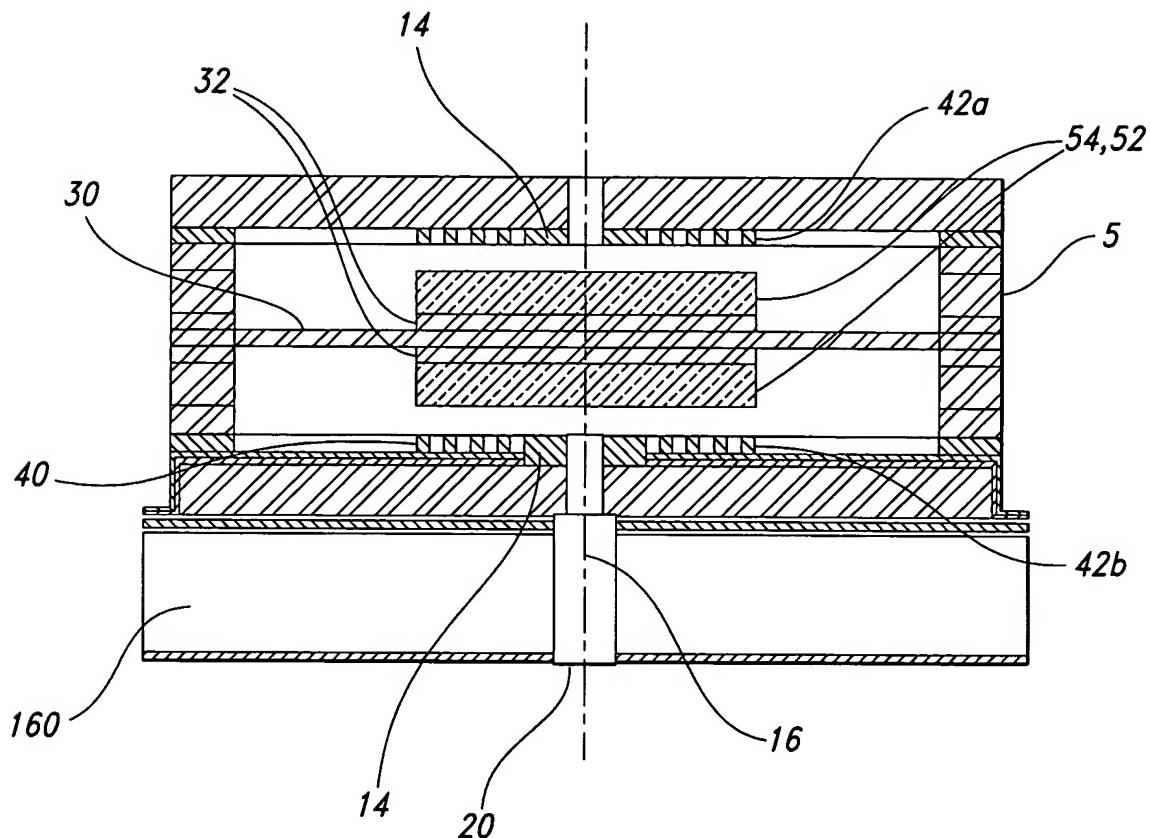
FIG. 41

+

*Replacement Sheet*

33/39

+



**FIG. 42**

+

*Replacement Sheet*

34/39

+

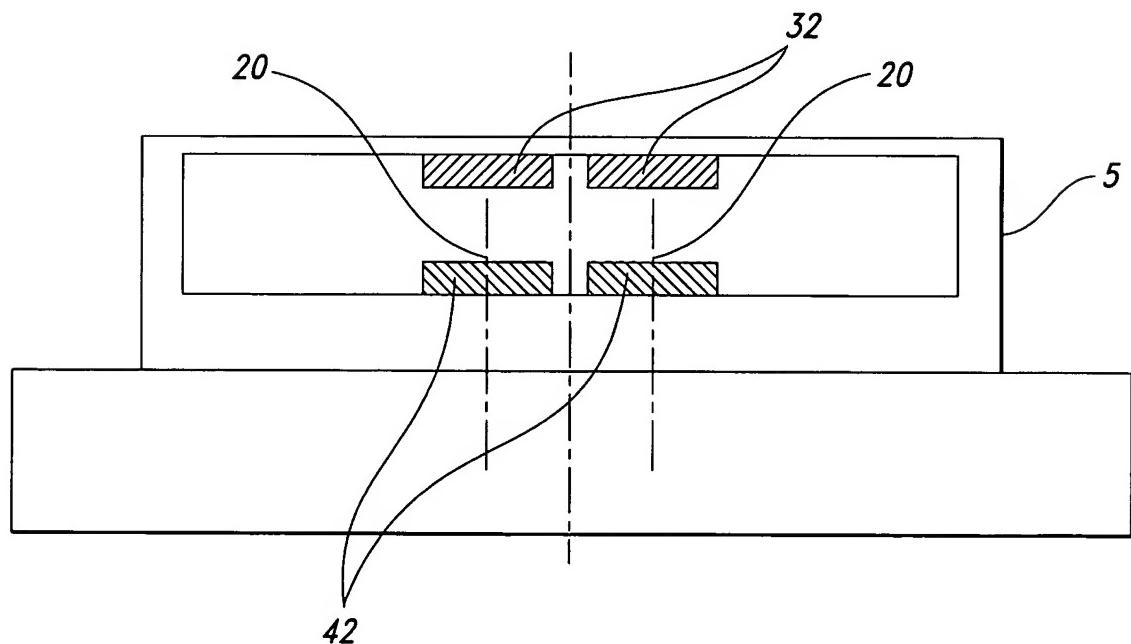
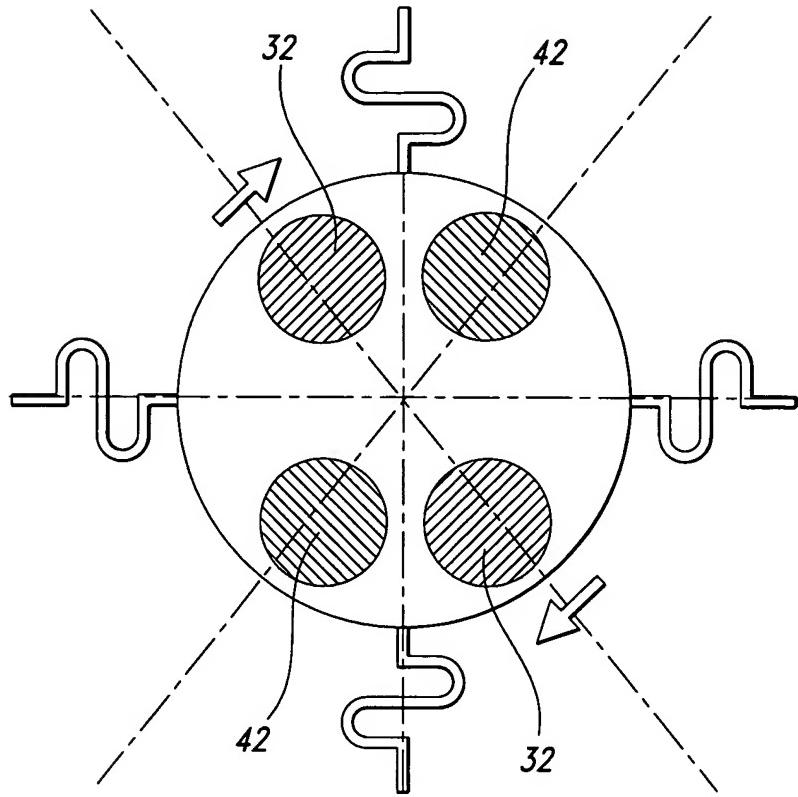


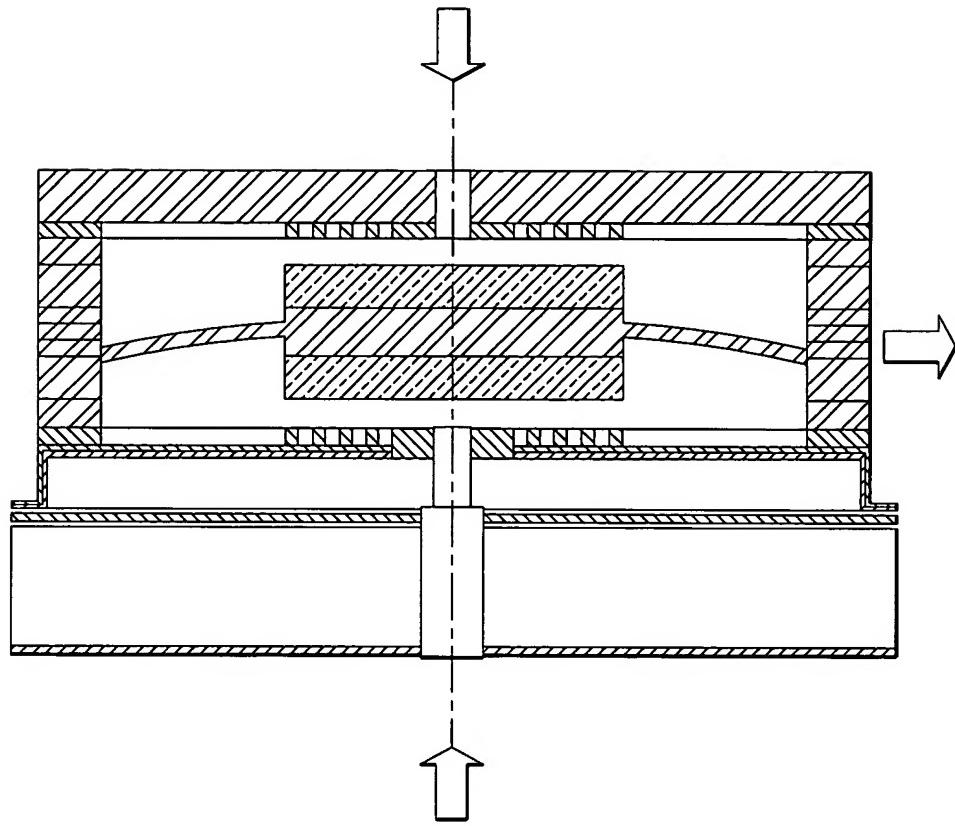
FIG. 43

+

*Replacement Sheet*

35/39

+



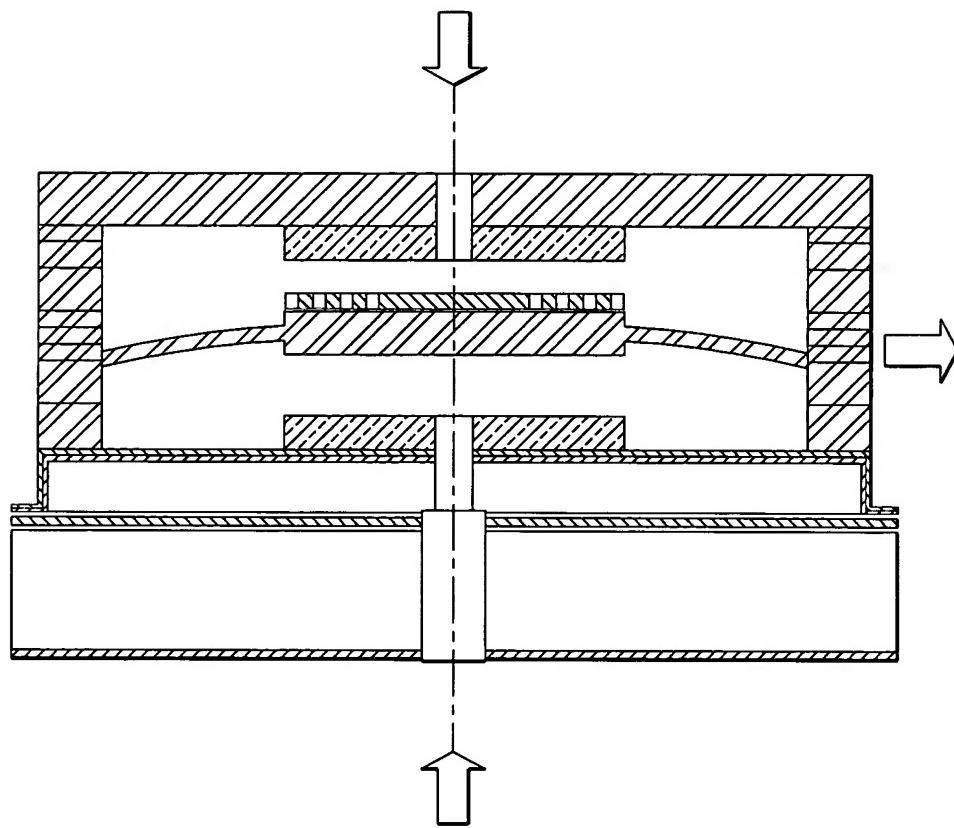
**FIG. 44**

+

*Replacement Sheet*

*36/39*

+



**FIG. 45**

+

*Replacement Sheet*  
37/39

+

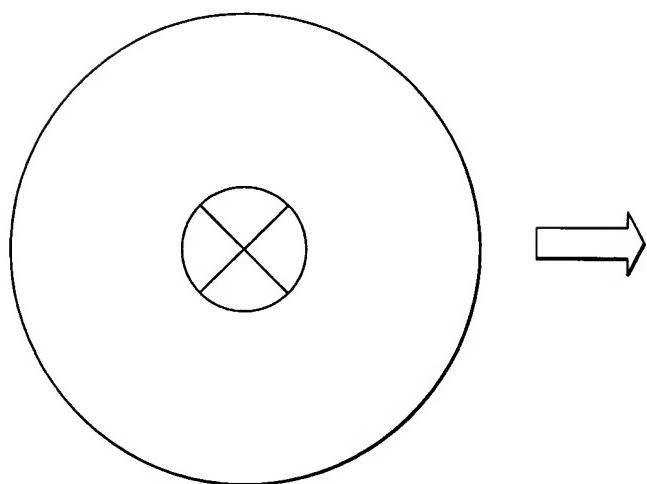
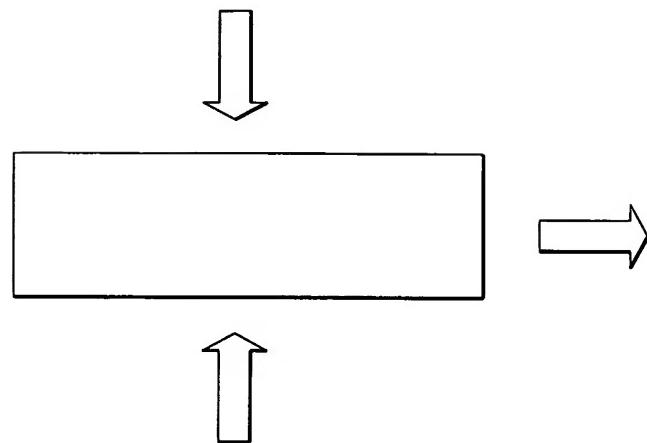
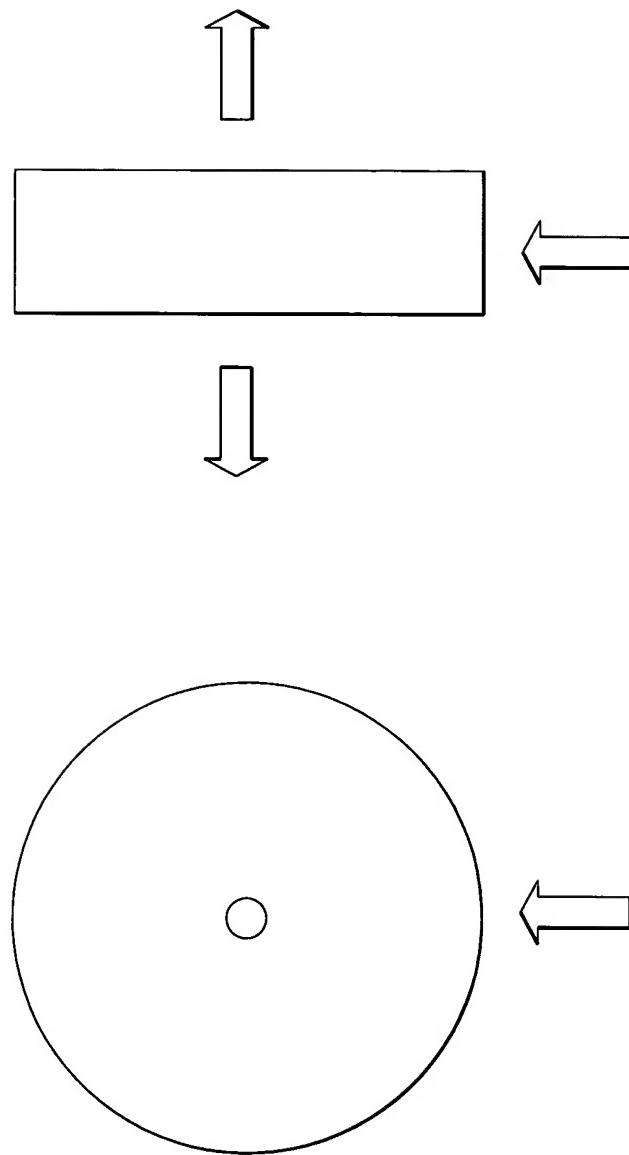


FIG. 46

+

*Replacement Sheet*  
38/39

+



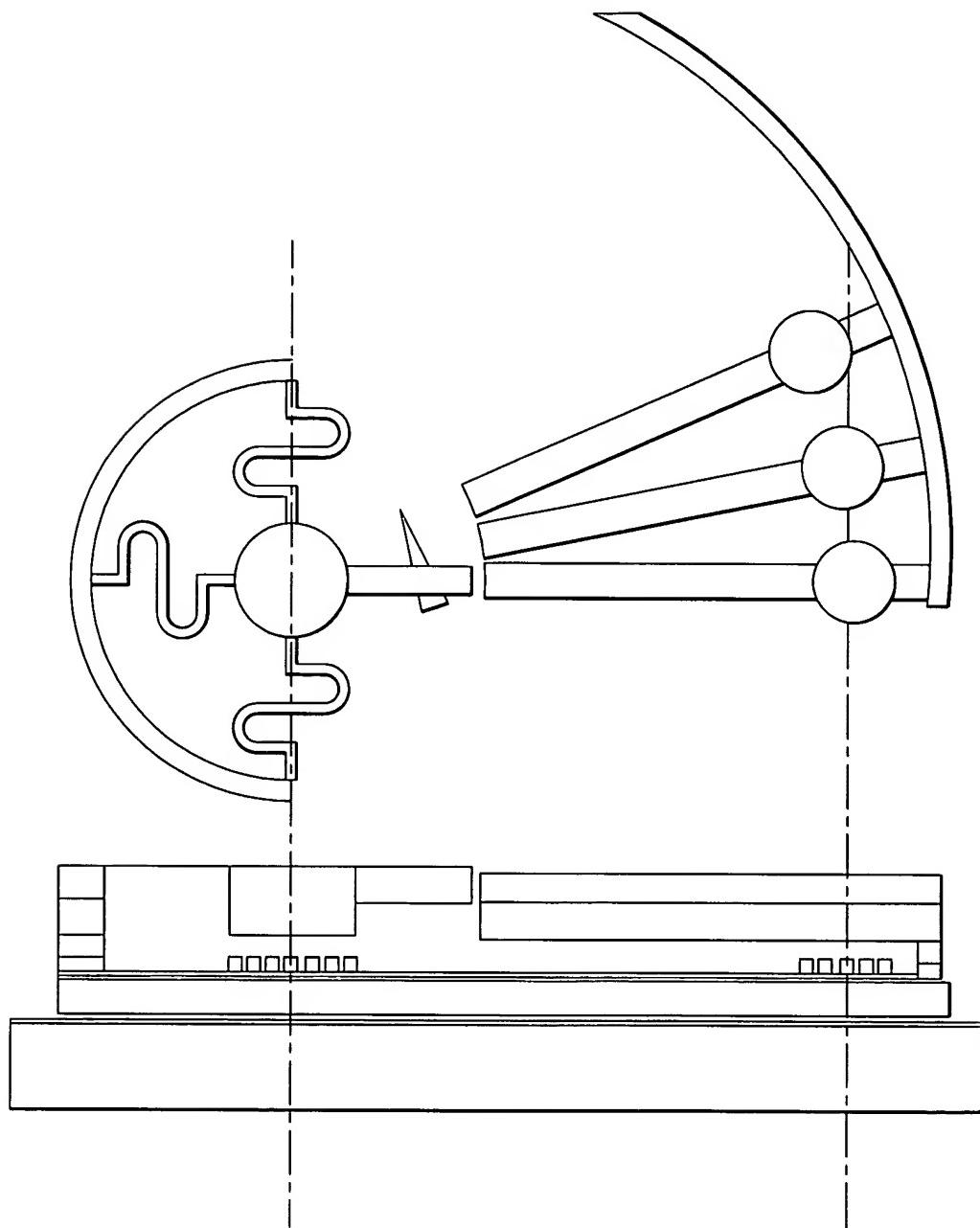
**FIG. 47**

+

*Replacement Sheet*

39/39

+



**FIG. 48**

+